REMARKS

This amendment is responsive to the non-Final Office Action of May 22, 2009. Reconsideration and allowance of **claims 1-17** are requested.

The Office Action

Claims 1-7 and 14-16 were rejected under 35 U.S.C. § 101.

Claim 1-16 was rejected under 35 U.S.C. § 102(b) as being anticipated by Yan et al. (A Model to Accumulate Fractionated Dose in a Deforming Organ).

The Present Application

The present application is directed to a method and apparatus for planning radiation therapy. A radiation dose distribution is adapted on the basis of shape and position variations of the organs of interest determined from a comparison of a first image and a second image which were taken at different points of time during the radiation treatment process.

The above description of the present application is presented to the Examiner as background information to assist the Examiner in understanding the application. The above description is not used to limit the claims in any way.

The References of Record

Yan et al. is directed to a model to quantify internal organ motion and a method to construct a cumulative dose in a deforming organ. A biomechanical model of an elastic body is used to quantify patient organ motion in the process of radiation therapy. Intertreatment displacements of volume elements in an organ of interest are obtained from multiple daily computed tomography (CT) measurements. The distributions of patient-specific organ motion are predicted and the cumulative dose distribution in the organ is estimated.

35 U.S.C. § 101

Claims 1-7 and 14-16 have been amended to address the non-statutory subject matter issue.

The Claims Distinguish Patentably Over the References of Record

Claim 1-16 are not anticipated by Yan et al. Applicants respectfully submit that this rejection is improper and/or erroneous. Accordingly, the rejection is hereby traversed.

More specifically, regarding **claim 1**, Yan et al. does not disclose determining at least one of shape and position variation of a surface of an object of interest in the target volume between the first image and second image and adjusting the dose distribution on the basis of the at least one of shape and position variation. The Examiner refers Applicant to page 666 Col. 2 Paragraph 2, page 669, Col. 1, Paragraph 1 which discloses using a planning CT image as a reference image to determine the original shape and position of an organ. The user defines fiducial points on the organ boundary in the reference image. A volume mesh is then applied to the reference image to generate volume elements. The meshing divides the entire organ volume into a number of volume elements. A three dimensional position of each volume element is registered. In addition to the reference slides, treatment CT images are acquired to measure intertreatment organ motion. On each the treatment images, fiducial points are defined on the contour of the organ's boundary. The volume mesh and fiducual points from the reference image in addition to the fiducial points of the organ in the treatment images are then imported into software for finite element analysis. The finite element analysis calculates a displacement map of volume elements within the organ. The displacement map of volume elements is used to determine the 3D displacement for each volume elements in the organ which is then used to estimate the shape and position of the organ as well as the dose distribution in the organ of interest. Moreover, **claim 1** refers to determining variation of a surface of an object whereas Yan et al. is directed to using the change in 3D displacement of volume elements to determine variation of shape and position of an organ. Yan et al. does not disclose using the difference between a first and second image to determine the shape and position variation of a surface of an object of interest.

Accordingly it is submitted that independent **claim 1** and **claims 2-7 and 12** that depend therefrom distinguish patentable over the references of record.

Claim 2 calls for obtaining a difference between the second surface mesh and the third surface mesh. Yan et al. discloses using a first volume mesh on the reference image. A volume mesh is a polygonal representation of the interior volume

of an object (see the slices of Fig. 1) unlike a surface mesh which uses polygons to represent the surface of an object. Further, Yan et al. discloses using only a first volume mesh and determining the shape and variation of a shape using a finite element analysis. Yan et al. does not disclose determining a difference between a second surface mesh and a third surface mesh.

Claim 3 calls for generating a volumetric model of the object of interest on the basis of the second surface mesh. Yan et al. is directed to using volume mesh and a finite element analysis to determine a volumetric model of an object. Yan et al. does not disclose using a second surface mesh to generate a volumetric model of the object.

Claim 9 calls for adapting the same (second) mesh that was adapted to the object in the first image to the object in the second image. First, Yan does not describe or fairly suggest re-adapting the mesh in this manner. Second, adapting the same mesh facilitates determining point correspondences between the surfaces in the first and second images. Third, adapting the mesh to the object in the second image is/determines the transform/change of the surface between the first and second images.

Accordingly it is submitted that independent **claim 9** and **claims 10 and 14** that depend therefrom distinguish patentable over the references of record.

Claim 9 calls for obtaining a difference between the second surface mesh and the third surface mesh and generating a volumetric model of the object of interest on the basis of the second surface mesh. Yan et al. discloses using volume mesh and a finite element analysis to determine shape and position variation of an object in addition to a volumetric model of an object. Yan et al. does not disclose determining differences between a second and third surface mesh and creating a model from the second surface mesh.

In reference to **claim 11,** Yan et al. does not disclose obtaining a difference between the second surface mesh and the third surface mesh, generating a volumetric model of the object of interest on the basis of the second surface mesh, and deforming the volumetric model on the basis of the difference resulting in a deformed volumetric model. Yan et al. is directed to determining a shape and position variation of volume elements of an object and using finite element analysis to determine a volumetric model. Yan et al does not disclose using multiple surface meshes to

determine shape and position differences and to generate and deform a volumetric model.

Claim 14 calls for deforming a volumetric model of the object of interest based on a difference between the first and second surface meshes. Yan et al. discloses using shape and position variation of volume elements to deform a volumetric model. Yan et al. does not disclose using surface meshes to determine shape and position variations and deform a volumetric model.

Accordingly it is submitted that independent **claim 14** and **claims 15-17** that depend therefrom distinguish patentable over the references of record.

CONCLUSION

For the reasons set forth above, it is submitted that **claims 1-17** (all claims) distinguish patentably over the references of record and meet all statutory requirements. An early allowance of all claims is requested.

In the event the Examiner considers personal contact advantageous to the disposition of this case, the Examiner is requested to telephone Thomas Kocovsky at 216.363.9000.

Respectfully submitted,

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